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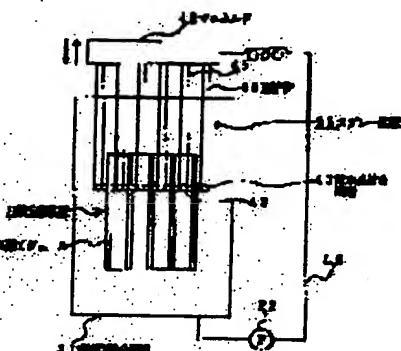
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(54) WASHING OF FILTER MEMBRANE

(57) Abstract:

PURPOSE: To easily and uniformly wash a membrane module without damaging a membrane or obstructing the flow of water to be treated.

CONSTITUTION: A membrane separator 32 is immersed in a treatment tank and treated water is separated from water to be treated by the membrane separator 32. The water to be treated in the treatment tank is discharged so as to leave a set amt. of water to be treated and the membrane module 41 of the membrane separator 32 is exposed to a gas phase. Next, the remaining water to be treated is taken out of the bottom part of the treatment tank to be supplied to a sprayer 35 and ejected to the membrane module 41 from the sprayer 35. Since the surface of a membrane is exposed to the gas phase, the momentum possessed by water to be treated can be allowed to directly act on the surface of the membrane. Therefore, the solid stuck to the surface of the membrane can be sufficiently peeled.



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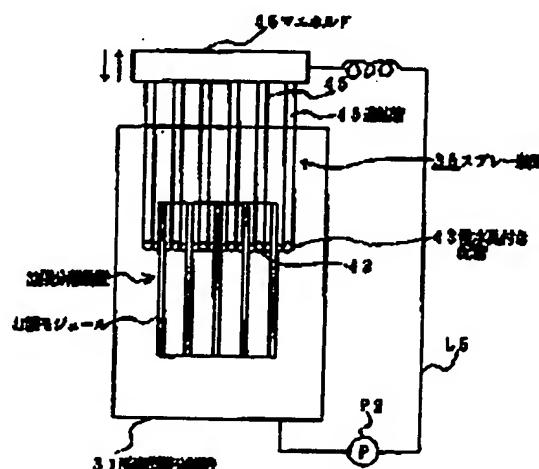
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(54) [発明の名稱] ろ過膜洗浄方法

〔57〕〔要約〕

【目的】膜が破損したり、該処理水の流れを阻害したりすることなく、膜モジュールを容易にかつ一様に洗浄することができるようとする。

【構成】処理槽に臍分離装置32を浸漬（しんせき）し、臍臍分離装置32によって被処理水から糞便水を分離させる。糞便槽内の被処理水を設定量だけ残留させて残出し、臍分離装置32の臍モジュール41を気相に露出させる。次に、残留した糞便水を処理槽の底部から取り出してスプレー装置35に供給し、スプレー装置35から臍モジュール41に噴射する。臍面を気相に露出しているので、糞便水が有する運動量を直接臍面に作用させることができる。したがって、臍面に付着した固形物を十分に剥離（はくり）させることができる。



【特許請求の範囲】

【請求項1】 处理槽に膜分離装置を設置し、該膜分離装置によって該処理水から処理水を分離させる廃水処理装置のろ過膜洗浄方法において、(a) 前記処理槽内の該処理水を設定量だけ残留させて排出し、前記膜分離装置の膜モジュールを気相に露出させ、(b) 残留した該処理水を処理槽の底部から取り出してスプレー装置に供給し、該スプレー装置から膜モジュールに噴射することを特徴とするろ過膜洗浄方法。

【請求項2】 该処理水を膜モジュールに噴射する際に、前記スプレー装置が膜面に沿って昇降させられる請求項1に記載のろ過膜洗浄方法。

【請求項3】 该処理水を膜モジュールに噴射する際に、該膜モジュールが回転させられる請求項1に記載のろ過膜洗浄方法。

【請求項4】 (a) 前記処理槽と生物処理水槽とが接続され、(b) 該生物処理水槽から前記処理槽に該処理水が供給されるとともに、(c) 前記処理槽から排出された該処理水が前記生物処理水槽に供給される請求項1に記載のろ過膜洗浄方法。

【請求項5】 (a) 前記処理槽と凝聚処理水槽とが接続され、(b) 該凝聚処理水槽から前記処理槽に該処理水が供給されるとともに、(c) 前記処理槽から排出された該処理水が前記凝聚処理水槽に供給される請求項1に記載のろ過膜洗浄方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、ろ過膜洗浄方法に関するものである。

【0002】

【従来の技術】 従来、夾縫(きょうざつ)物、汚泥等を含む廃水をろ過して清澄水(以下「処理水」という。)を得るために、精密ろ過膜、限外ろ過膜等の膜モジュールが使用される。この場合、浸漬(しんせき)型膜分離槽に該処理水を供給し、該該処理水側を加圧するか、処理水側を減圧するかして、該処理水中の処理水だけ透過させるようになっている。

【0003】 前記該処理水中の夾縫物、汚泥等は膜モジュールの表面(以下「膜面」という。)に残留する。そして、該処理水を繰り返し処理していると、残留した夾縫物、汚泥等が次第に膜面に固形物として付着し、ケーブルを形成して膜モジュールの透過性能を低下させてしまう。そこで、各種の方法によって膜モジュールを洗浄し、膜面から固形物を除去するようしている。

【0004】 すなわち、膜モジュールの処理水側から該処理水側に空気を逆流させる空気逆洗浄法、該処理水内において膜面にスポンジボールを当てる方法、膜モジュールを浸漬型膜分離槽から取り出し、膜面に高圧の洗浄水をスプレーする方法等がある。図2は従来の空気逆洗浄法

を示す図である。

【0005】 図において、11は浸漬型膜分離槽であり、ラインL1を介して該処理水が供給される。また、12は複数の平面の膜モジュール21から成り、浸漬型膜分離槽11に浸漬された膜分離装置であり、処理水側がポンプP1によって減圧される。前記膜分離装置12の下方には、散気装置13が配設される。該散気装置13にはプロア14が接続され、該プロア14から吐出された空気がラインL2を介して散気管15に供給され、該散気管15から噴射される。そして、噴射された空気は浸漬型膜分離槽11内を上昇し、該処理水を巻き込んで循環させる。

【0006】 前記膜分離装置12においては、膜モジュール21の処理水側が減圧されるので、各膜モジュール21間を上昇する該処理水中の処理水だけが膜を透過し、ラインL3を介して排出される。また、18はラインL4を介して各膜モジュール21に空気を供給するプロアであり、処理水側から該処理水側に圧縮された空気を逆流させることによって、膜面から固形物を除去する。なお、各ラインL2～L4にはバルブ22～24がそれぞれ配設され、必要に応じて開閉される。

【0007】

【発明が解決しようとする課題】 しかしながら、前記従来のろ過膜洗浄方法においては、活性汚泥を用いた生物処理において膜モジュールを使用したり、凝聚剤を添加した後の凝聚処理において膜モジュールを使用したりすると、処理水側を減圧する低圧ろ過法を使用した場合でも、膜面に付着した固形物の付着力が大きく、固形物を容易に除去することはできない。

【0008】 また、図2に示す空気逆洗浄法では処理水側に圧縮された空気が供給されるので、膜が膨張し、洗浄が頻繁に行われると、膜の支持部において破損することがある。そして、該処理水内において膜面にスポンジボールを当てる方法では、チューブラ型の膜モジュールに適用すると効果的であるが、平面の膜モジュールに適用した場合、膜モジュールを10～30[m]程度の間隔で複数枚積層する必要があるので、該処理水の流れを阻害するとともに、各膜モジュール間(以下「膜間」という。)においてスポンジボールを均一に分散させることができない。

【0009】 さらに、膜モジュールを浸漬型膜分離槽から取り出し、膜面に高圧の洗浄水をスプレーする方法では、膜モジュールを浸漬型膜分離槽に対しても着脱する作業が煩わしいだけでなく、除去された固形物を含む洗浄水を処理する必要が生じる。本発明は、前記従来のろ過膜洗浄方法の問題点を解決して、膜が破損したり、該処理水の流れを阻害したりすることなく、膜モジュールを容易にかつ一緒に洗浄することができるろ過膜洗浄方法を提供することを目的とする。

【0010】

【課題を解決するための手段】そのために、本発明のろ過洗浄方法においては、処理槽に膜分離装置を浸漬し、該膜分離装置によって該処理水から処理水を分離するようになっている。そして、前記処理槽内の該処理水を設定量だけ残留させて排出し、前記膜分離装置の膜モジュールを気相に露出させる。次に、残留した該処理水を処理槽の底部から取り出してスプレー装置に供給し、該スプレー装置から膜モジュールに噴射する。

【0011】本発明の他のろ過洗浄方法においては、該処理水を膜モジュールに噴射する際に、前記スプレー装置が膜面に沿って昇降させられる。本発明の更に他のろ過洗浄方法においては、該処理水を膜モジュールに噴射する際に、該膜モジュールが回転させられる。本発明の更に他のろ過洗浄方法においては、前記処理槽と生物処理水槽とが接続され、該生物処理水槽から前記処理槽に該処理水が供給されるとともに、前記処理槽から排出された該処理水が前記生物処理水槽に供給される。

【0012】本発明の更に他のろ過洗浄方法においては、前記処理槽と凝集処理水槽とが接続され、該凝集処理水槽から前記処理槽に該処理水が供給されるとともに、前記処理槽から排出された該処理水が前記凝集処理水槽に供給される。

【0013】

【作用】本発明によれば、前記のろ過洗浄方法においては、処理槽に膜分離装置を浸漬し、該膜分離装置によって該処理水から処理水を分離するようになっている。そして、前記処理槽内の該処理水を設定量だけ残留させて排出し、前記膜分離装置の膜モジュールを気相に露出させる。次に、残留した該処理水を処理槽の底部から取り出してスプレー装置に供給し、該スプレー装置から膜モジュールに噴射する。

【0014】この場合、該処理水を膜モジュールに噴射する際、膜面を気相に露出するようになっているので、該処理水が有する運動量を直接膜面に作用させることができる。本発明の他のろ過洗浄方法においては、該処理水を膜モジュールに噴射する際に、前記スプレー装置が膜面に沿って昇降させられる。この場合、噴射された該処理水が膜モジュールの全体に当たられる。

【0015】本発明の更に他のろ過洗浄方法においては、該処理水を膜モジュールに噴射する際に、該膜モジュールが回転させられる。この場合、噴射された該処理水が膜モジュールの全体に当たられる。本発明の更に他のろ過洗浄方法においては、前記処理槽と生物処理水槽とが接続され、該生物処理水槽から前記処理槽に該処理水が供給されるとともに、前記処理槽から排出された該処理水が前記生物処理水槽に供給される。この場合、生物処理が終了した該処理水から処理水を分離することができる。

【0016】本発明の更に他のろ過洗浄方法において

は、前記処理槽と凝集処理水槽とが接続され、該凝集処理水槽から前記処理槽に該処理水が供給されるとともに、前記処理槽から排出された該処理水が前記凝集処理水槽に供給される。この場合、凝集処理が終了した該処理水から処理水を分離することができる。

【0017】

【実施例】以下、本発明の実施例について図面を参照しながら詳細に説明する。図3は本発明の第1の実施例におけるろ過洗浄装置の概念図である。図において、3

10 1は処理槽としての浸漬型膜分離槽であり、ラインL1を介して該処理水が供給される。また、32は複数の平面型の図示しない膜モジュールから成り、浸漬型膜分離槽31に浸漬された膜分離装置であり、該処理水中の処理水だけが膜モジュールの膜を透過して処理水側に送られる。

【0018】また、33は前記浸漬型膜分離槽31の底部に形成された水抜管であり、該水抜管33に配設された図示しないバルブを操作することによって、浸漬型膜分離槽31内の該処理水を排出することができる。前記20 膜分離装置32の各膜モジュールに対応させてスプレー装置35が配設され、該スプレー装置35と浸漬型膜分離槽31の底部とがラインL5によって接続される。該ラインL5にはポンプP2が配設され、該ポンプP2によって底部の該処理水が循環させられ、スプレー装置35から膜モジュールに噴射される。

【0019】次に、前記構成のろ過洗浄装置の動作について説明する。まず、ラインL1を介して浸漬型膜分離槽31に該処理水を供給し、ろ過処理を開始する。該ろ過処理において、該処理水中の処理水だけが膜モジュールの膜を透過して処理水側に送られ、夾雑物、汚泥等は膜面に残留する。そして、該処理水を繰り返し処理していると、残留した夾雑物、汚泥等が次第に膜面に固形物として付着し、ケーキ層を形成する。

【0020】そこで、膜モジュール32によって得られた処理水が必要量を下まわったときに、該処理水の供給を停止させ、ろ過洗浄処理を開始する。すなわち、前記バルブを操作して水抜管33を介して浸漬型膜分離槽31内の該処理水を排出し、膜分離装置32の膜面を気相に露出させる。このとき、スプレー用水として浸漬型膜分離槽31内の該処理水を一定量噴す。

【0021】そして、ポンプP2を作動させ、底部の該処理水をラインL5を介して循環させ、スプレー装置35から膜モジュールに高圧で噴射する。該処理水を一定時間噴射した後、浸漬型膜分離槽31に該処理水を再び供給し、該該処理水が設定された水位に達すると、ろ過処理を再開する。この場合、前記該処理水を膜モジュールに噴射する際、膜面を気相に露出するようになっているので、該処理水が有する運動量を直接膜面に作用させることができる。したがって、該処理水が膜面に当たったときの衝撃力は大きく、膜面に付着した固形物を十

分に異常（はくり）させることができる。その結果、圖形物を容易に除去することができる。

【0022】また、被処理水を洗浄用として使用するので、別の洗浄水を使用する必要がないだけでなく、除去された圖形物を含む洗浄水を処理する必要もないので、コストを低くすることができます。そして、圧縮された空気を使用しないので、駆動が騒音されることなく、スプレンジボールを使用しないので、膜モジュールを一様に洗浄することができ、さらに、該膜モジュールを浸漬型膜分離槽から取り出す必要がないので、作業が簡素化される。

【0023】次に、膜分離装置32及びスプレー装置35について詳細に説明する。図1は本発明の実施例におけるろ過膜洗浄装置の詳細図である。図において、31は浸漬型膜分離槽であり、該浸漬型膜分離槽31に膜分離装置32が浸漬される。該膜分離装置32は、矩形（くけい）形状の膜モジュール41を所定間隔を置いて複数枚積層することによって形成される。

【0024】また、前記膜分離装置32の各膜モジュール41に対応させてスプレー装置35が配設される。該スプレー装置35は複数の散水孔付き配管43から成り、該散水孔付き配管43は、各膜モジュール41間及び最も外側の膜モジュール41に隣接する位置に配設される。各散水孔付き配管43には図示しない散水孔が形成され、該散水孔から被処理水が噴射される。この場合、前記散水孔は、散水孔付き配管43の下部の膜モジュール53の半径相当の長さにわたって形成される。そして、前記散水孔付き配管43の上端には共通のマニホールド57が接続される。ところで、前記膜モジュール53は図示しない駆動機構によって回転させることができるので、該処理水を膜面の全体に当てることができる。

【0025】前記散水孔付き配管43は、前記膜モジュール41の膜幅に相当する長さを有し、水平に配設される。そして、各散水孔付き配管43には並んで延びる連絡管45が接続され、該連絡管45の上端には共通のマニホールド46が接続される。一方、該マニホールド46と浸漬型膜分離槽31の底部とがラインし5によって接続される。該ラインし5にはポンプP2が配設され、底部の被処理水が循環させられ、マニホールド46及び連絡管45を介して散水孔付き配管43に供給され、該散水孔付き配管43の散水孔から膜モジュール41に噴射される。

【0026】ところで、前記マニホールド46は図示しない駆動機構によって、矢印方向に昇降させることができようになっているので、散水孔付き配管43を膜モジュール41に沿って昇降させ、被処理水を膜面の全体に当てることができる。例えば、被処理水の噴射を開始するとともに、散水孔付き配管43を下降させ、該散水孔付き配管43が膜モジュール41の下端に達すると、散水孔付き配管43を上昇させる。そして、散水孔付き配管43の昇降を複数回又は一定時間繰り返す。ろ過膜洗浄処理が終了した後は、ろ過処理における被処理水の運動を妨げないように、前記散水孔付き配管43を膜モジュール41の上端より上方に移動させておく。

【0027】このようにして、散水孔付き配管43を昇降させることができるので、膜モジュール41の膜面を

一様に洗浄することができる。次に、本発明の第2の実施例について説明する。図4は本発明の第2の実施例におけるろ過膜洗浄装置の詳細図である。図において、31は処理槽としての浸漬型膜分離槽であり、該浸漬型膜分離槽31に膜分離装置52が浸漬される。該膜分離装置52は、ディスク形状の膜モジュール53を所定間隔を置いて複数枚積層し、軸54によって回転自在に支持することによって形成される。

【0028】また、前記膜分離装置52の各膜モジュール53に対応させてスプレー装置55が配設される。該スプレー装置55は複数の散水孔付き配管56から成り、該散水孔付き配管56は各膜モジュール53間及び最も外側の膜モジュール53に隣接する位置に配設される。各散水孔付き配管56には、図示しない散水孔が形成され、該散水孔から被処理水が噴射される。この場合、前記散水孔は、散水孔付き配管56の下部の膜モジュール53の半径相当の長さにわたって形成される。そして、前記散水孔付き配管56の上端には共通のマニホールド57が接続される。ところで、前記膜モジュール53は図示しない駆動機構によって回転させることができようになっているので、該処理水を膜面の全体に当てることができる。

【0029】一方、前記マニホールド57と浸漬型膜分離槽31の底部とがラインし5によって接続される。該ラインし5にはポンプP2が配設され、底部の被処理水が循環させられ、マニホールド57を介して散水孔付き配管56に供給され、該散水孔付き配管56の散水孔から膜モジュール53に噴射される。この場合、散水孔付き配管56は固定されているが、膜モジュール53が回転させられるので、該膜モジュール53の膜面を一様に洗浄することができる。

【0030】次に、本発明の第3の実施例について説明する。図5は本発明の第3の実施例におけるろ過膜洗浄装置の概念図である。この場合、高負荷の生物処理を行う工程においてろ過膜洗浄装置が使用される。そのため、生物処理水槽61と処理槽としての浸漬型膜分離槽31とをラインし1及び水抜管33によって接続し、生物処理水槽61において生物処理を行い、浸漬型膜分離槽31においてろ過処理及びろ過膜洗浄処理を行う。該ろ過膜洗浄処理において、ポンプP2が作動させられ、浸漬型膜分離槽31の底部の被処理水がラインし5を介してスプレー装置35に供給され、該スプレー装置35から膜分離装置32の膜モジュール41（図1）に噴射される。そして、ろ過処理において該処理水から処理水（生物処理水）が分離させられるのに伴い、被処理水が濃縮され、該被処理水が水抜管33を介して生物処理水槽61に返送される。したがって、該生物処理水槽61内において高い菌体濃度を維持することができる。なお、し6は被処理水の原水供給ライン、し7はろ過時ににおいて被処理水の一部を引き抜くためのラインである。

【0031】ところで、前記スプレー装置35によって被処理水を噴モジュール41に噴射するに当たり、該面を気相に露出させるために、水抜管33を介して浸漬型膜分離槽31内の被処理水が排出される。この場合、水抜管33は生物処理水槽61と接続され、排出された被処理水は生物処理水槽61に供給される。そこで、生物処理水槽61には、浸漬型膜分離水槽31の抜水量分の空容積を確保しておく必要がある。また、排出された被処理水を生物処理水槽61に供給するために、水抜管33にポンプP3が配設される。

【0032】次に、前記構成のろ過洗浄装置の動作について説明する。まず、ラインL1を介して生物処理水槽61から浸漬型膜分離槽31に被処理水を供給し、ろ過処理を開始する。該ろ過処理において、被処理水中の処理水だけが噴モジュール41の膜を透過して処理水側に送られ、夾雜物、汚泥等は該面に残留する。そして、被処理水を繰り返し処理していると、残留した夾雜物、汚泥等が次第に該面に固形物として付着し、ケーキ層を形成する。

【0033】そこで、噴モジュール41によって得られた処理水が必要量を下まわったときに、被処理水の供給を停止させ、ろ過洗浄処理を開始する。すなわち、前記ポンプP3を作動させて水抜管33を介して浸漬型膜分離槽31内の被処理水を排出し、生物処理水槽61に供給する。そして、膜分離装置32の該面を気相に露出させる。このとき、スプレー用水として浸漬型膜分離槽31内の被処理水を一定量噴す。

【0034】そして、ポンプP2を作動させ、浸漬型膜分離槽31の底部の被処理水をラインL5を介して循環させ、スプレー装置35から噴モジュール41に高圧で噴射する。被処理水を一定時間噴射した後、ポンプP2を停止させ、浸漬型膜分離槽31に被処理水を再び供給し、該被処理水が設定された水位に達すると、ろ過処理を再開する。

【0035】次に、本発明の第4の実施例について説明する。図6は本発明の第4の実施例におけるろ過洗浄装置の概念図である。この場合、被処理水に塩化第二鉄等の凝集剤を添加して溶解性COD成分等を除去する凝集工程においてろ過洗浄装置が使用される。そのため、凝集処理水槽62と処理槽としての浸漬型膜分離槽31とをラインL1及び水抜管33によって接続し、前記凝集処理水槽62において凝集処理を行い、浸漬型膜分離槽31においてろ過処理及びろ過洗浄処理を行う。なお、L6は被処理水の原水供給ライン、L7はろ過時ににおいて被処理水の一部を引き抜くためのラインである。

【0036】前記ろ過処理において被処理水から処理水が分離せられる。また、ろ過洗浄処理においてポンプP2が作動させられ、浸漬型膜分離槽31の底部の被処理水がラインL5を介してスプレー装置35に供給さ

れ、該スプレー装置35から膜分離装置32の噴モジュール41(図1)に噴射される。その結果、ろ過処理において該面に残留した固形物質を除去することができる。

【0037】ところで、前記スプレー装置35によって被処理水を噴モジュール41に噴射するに当たり、該面を気相に露出させるために、水抜管33を介して浸漬型膜分離槽31内の被処理水が排出される。この場合、水抜管33は凝集処理水槽62に接続され、排出された被処理水は凝集処理水槽62に供給される。そこで、該凝集処理水槽62には、浸漬型膜分離水槽31の抜水量分の空容積を確保しておく必要がある。また、排出された被処理水を凝集処理水槽62に供給するために、水抜管33にポンプP3が配設される。

【0038】なお、本発明は前記実施例に限定されるものではなく、本発明の趣旨に基づいて種々変形させることができると認められ、これらを本発明の範囲から排除するものではない。

【0039】

【発明の効果】以上詳細に説明したように、本発明によれば、ろ過洗浄方法においては、処理槽に膜分離装置を浸漬し、該膜分離装置によって被処理水から処理水を分離するようになっている。そして、前記処理槽内の被処理水を設定量だけ残留させて排出し、前記膜分離装置の噴モジュールを気相に露出させる。次に、残留した被処理水を処理槽の底部から取り出してスプレー装置に供給し、該スプレー装置から噴モジュールに噴射する。

【0040】この場合、被処理水を噴モジュールに噴射する際、該面を気相に露出させるようになっているので、被処理水が有する運動量を直接該面に作用させることができ。したがって、被処理水が該面に当たったときの衝撃力は大きく、該面に付着した固形物を十分に剥離することができる。その結果、固形物を容易に除去することができる。

【0041】また、被処理水を洗浄用として使用するので、別の洗浄水を使用する必要がないだけでなく、除去された固形物を含む洗浄水を処理する必要もないので、コストを低くすることができる。そして、圧縮された空気を使用しないので、膜が破損することなく、スプレーボールを使用しないので、噴モジュールを一様に洗浄することができ。さらに、該噴モジュールを処理槽から取り出す必要がないので、作業が簡素化される。

【0042】本発明の他のろ過洗浄方法においては、被処理水を噴モジュールに噴射する際に、前記スプレー装置が該面に沿って界離させられる。この場合、噴射された被処理水が噴モジュールの全体に当たられる。したがって、該噴モジュールの該面を一様に洗浄することができる。本発明の更に他のろ過洗浄方法においては、被処理水を噴モジュールに噴射する際に、該噴モジュールが回転させられる。この場合、噴射された被処理水が

膜モジュールの全体に当たられる。したがって、酸膜モジュールの膜面を一掃に通過することができる。

【0043】本発明の更に他のる過濾洗浄方法においては、前記処理槽と生物処理槽とが接続され、該生物処理槽から前記処理槽に該処理水が供給されるとともに、前記処理槽から排出された被処理水が前記生物処理槽に供給される。この場合、生物処理が終了した該処理水から処理水を分離させることができる。したがって、洗浄された該処理水を生物処理槽に返送することができる。生物処理槽において高い菌体濃度を維持することができる。

（図書の簡単な説明）

【図1】本発明の実施例におけるろ過膜洗浄装置の詳細図である。

【図2】管楽の空気逆流性を示す図である。

* [図3] 本発明の第1の実施例におけるろ過膜洗浄装置の概要図である。

【図4】本発明の第2の実施例におけるろ過膜洗浄装置の構成図である。

【図5】本発明の第3の実施例におけるろ過膜洗浄装置の概要図である。

【図6】本発明の第4の実施例におけるろ過膜洗浄装置の構成図である。

【符号の説明】

〔石量の推測〕

10.3.1 程序型随机数

3.2 5.2 隨分數找尋

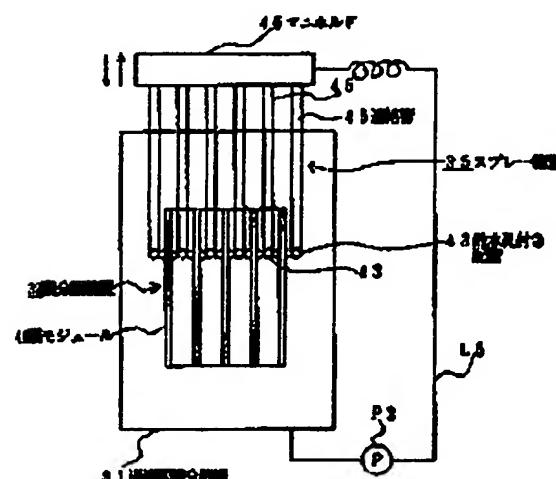
35 55 スプレー練習

41 53 諸モジ

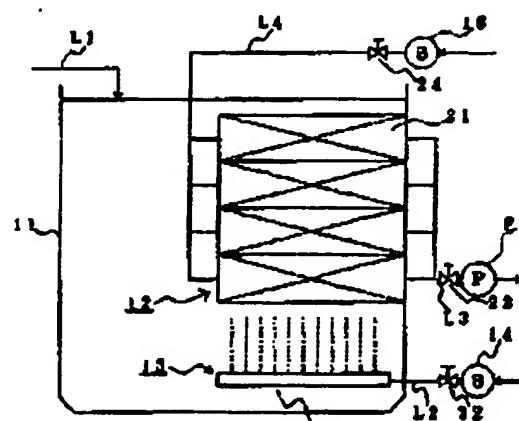
6.1 生物氮肥术语

62 經管外語本樓

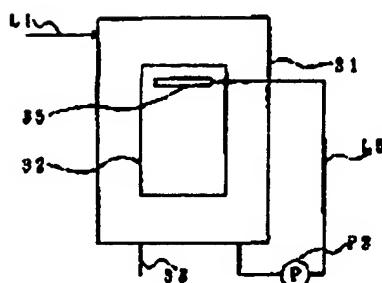
〔圖三〕



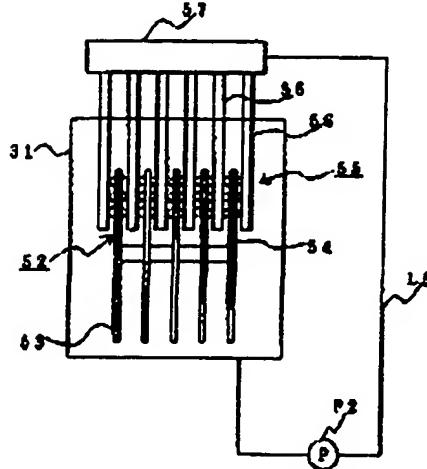
【图2】



【圖3】



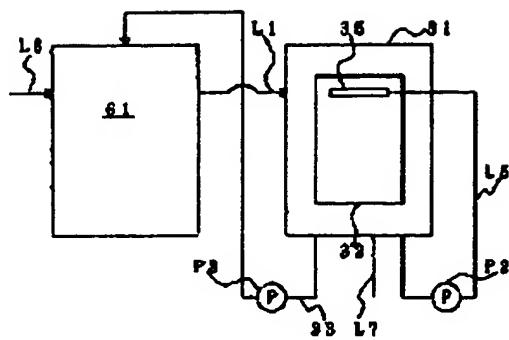
四十一



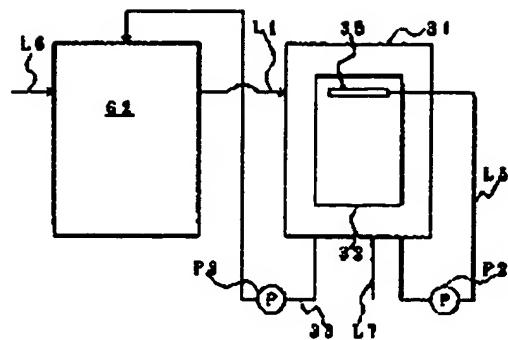
(7)

特開平8-206472

【図5】



【図6】



* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the filtration film washing approach.

[0002]

[Description of the Prior Art] In order to filter the raw water containing a contamination (today ****) object, sludge, etc. and to obtain clarified water (henceforth "treated water") conventionally, membrane modules, such as a membrane filter and ultrafiltration membrane, are used. In this case, processed water is supplied to an immersion (****) mold membrane-separation tub, a membrane module is immersed in this processed water, and only processed underwater treated water is made to penetrate by pressurizing the processed water side of a membrane module, or decompressing a treated water side.

[0003] Said processed underwater impurity, sludge, etc. remain on the surface of a membrane module (henceforth a "film surface"). And if processed water is repeated and processed, impurity, sludge, etc. which remained will adhere to a film surface as solids gradually, a cake layer will be formed, and the penetrable ability of a membrane module will be reduced. Then, he washes a membrane module and is trying to remove a solid from a film surface by various kinds of approaches.

[0004] That is, the air back wash method make air flow backwards from the treated water side of a membrane module to a processed water side, the approach of applying a sponge ball to a film surface in processed Mizuuchi, and a membrane module are taken out from a dipping former membrane-separation tub, and there is the approach of carrying out the spray of the high-pressure wash water to a film surface etc. Drawing 2 is drawing showing the conventional air back wash method.

[0005] In drawing, 11 is a dipping former membrane-separation tub, and processed water is supplied through Rhine L1. Moreover, 12 consists of the membrane module 21 of two or more flat tips, it is the membrane separation device immersed in the dipping former membrane-separation tub 11, and a treated water side is decompressed with a pump P1. A diffuser 13 is arranged under said membrane separation device 12. Blois 14 is connected to this diffuser 13, and the air breathed out from this Blois 14 is supplied to the powder trachea 15 through Rhine L2, and is injected from this powder trachea 15. And the injected air goes up the inside of the dipping former membrane-separation tub 11, and involves in and circulates processed water.

[0006] In said membrane separation device 12, since the treated water side of a membrane module 21 is decompressed, only the processed underwater treated water which goes up between each membrane module 21 penetrates the film, and is discharged through Rhine L3. Moreover, 18 is Blois which supplies air to each membrane module 21 through Rhine L4, and removes a solid from a film surface by making the air compressed into the processed water side from the treated water side flow backwards. In addition, bulbs 22-24 are arranged by each Rhine L2-L4, respectively, and are opened if needed and closed.

[0007]

[Problem(s) to be Solved by the Invention] However, in said conventional filtration film washing approach, even when a membrane module is used, or the membrane module was used in the coagulation treatment after adding a flocculant in the biological treatment using active sludge and the low voltage filtration which decompresses a treated water side is used, the adhesion force of the solid adhering to a film surface is large, and cannot remove a solid easily.

[0008] Moreover, since the air compressed into the treated water side by the air back wash method shown in drawing 2 is supplied, when the film expands and washing is performed frequently, it may damage in a membranous supporter. And by the approach of applying a sponge ball to a film surface in processed Mizuuchi, although it is effective if it applies to the membrane module of a tubular mold While checking the flow of processed water since it is necessary to carry out two or more sheet laminating of the membrane module at intervals of 10-30 [mm] extent when it applies to the membrane module of a flat tip, it is between each membrane module (it is called "between film" below.). It is difficult to set and to make homogeneity distribute a sponge ball, and it cannot wash a membrane module uniformly.

[0009] Furthermore, it will be necessary to take out a membrane module from a dipping former membrane-separation tub, and to process the wash water with which the activity which detaches and attaches a membrane module to a dipping former membrane-separation tub contains the solid it is not only troublesome, but removed by the approach of carrying out the spray of the high-pressure wash water to a film surface. This invention aims at offering the filtration film washing approach which can wash a membrane module easily and uniformly, without solving the trouble of said conventional filtration film washing approach, damaging the film or checking the flow of processed water.

[0010]

[Means for Solving the Problem] Therefore, a membrane separation device is immersed in a processing tub, and this membrane separation device is made to separate treated water from processed water in the filtration film washing approach of this invention. And only the amount of setup is made to remain, the processed water in said processing tub is discharged, and the membrane module of said membrane separation device is exposed to a gaseous phase. Next, the processed water which remained is taken out from the pars basilaris ossis occipitalis of a processing tub, spray equipment is supplied, and it injects from this spray equipment to a membrane module.

[0011] In case processed water is injected to a membrane module, said spray equipment is made to go up and down along with a film surface in other filtration film washing approaches of this invention. In the filtration film washing approach of further others of this invention, in case processed water is injected to a membrane module, this membrane module is rotated. In the filtration film washing approach of further others of this invention, while said processing tub and biological treatment tank are connected and processed water is supplied to said processing tub from this biological treatment tank, the processed water discharged from said processing tub is supplied to said biological treatment tank.

[0012] In the filtration film washing approach of further others of this invention, while said processing tub and a condensation treated water tub are

connected and processed water is supplied to said processing tub from this condensation treated water tub, the processed water discharged from said processing tub is supplied to said condensation treated water tub.

[0013]

[Function] According to this invention, a membrane separation device is immersed in a processing tub, and this membrane separation device is made to separate treated water from processed water in the filtration film washing approach as mentioned above. And only the amount of setup is made to remain, the processed water in said processing tub is discharged, and the membrane module of said membrane separation device is exposed to a gaseous phase. Next, the processed water which remained is taken out from the pars basilaris ossis occipitalis of a processing tub, spray equipment is supplied, and it injects from this spray equipment to a membrane module.

[0014] In this case, since a film surface is exposed to a gaseous phase in case processed water is injected to a membrane module, the momentum which processed water has can be made to act on a direct film surface. In case processed water is injected to a membrane module, said spray equipment is made to go up and down along with a film surface in other filtration film washing approaches of this invention. In this case, the injected processed water is applied by the whole membrane module.

[0015] In the filtration film washing approach of further others of this invention, in case processed water is injected to a membrane module, this membrane module is rotated. In this case, the injected processed water is applied by the whole membrane module. In the filtration film washing approach of further others of this invention, while said processing tub and biological treatment tank are connected and processed water is supplied to said processing tub from this biological treatment tank, the processed water discharged from said processing tub is supplied to said biological treatment tank. In this case, treated water can be made to separate from the processed water which biological treatment ended.

[0016] In the filtration film washing approach of further others of this invention, while said processing tub and a condensation treated water tub are connected and processed water is supplied to said processing tub from this condensation treated water tub, the processed water discharged from said processing tub is supplied to said condensation treated water tub. In this case, treated water can be made to separate from the processed water which the coagulation treatment ended.

[0017]

[Example] Hereafter, it explains to a detail, referring to a drawing about the example of this invention. Drawing 3 is the conceptual diagram of the filtration film washing station in the 1st example of this invention. In drawing, 31 is a dipping former membrane-separation tub as a processing tub, and processed water is supplied through Rhine L1. Moreover, 32 consists of the membrane module which two or more flat tips do not illustrate, and it is the membrane separation device immersed in the dipping former membrane-separation tub 31, and only processed underwater treated water penetrates the film of a membrane module, and it is sent to a treated water side.

[0018] Moreover, 33 is the water extubation formed in the pars basilaris ossis occipitalis of said dipping former membrane-separation tub 31, and can discharge the processed water in the dipping former membrane-separation tub 31 by operating the bulb which was arranged in this water extubation 33 and which is not illustrated. Each membrane module of said membrane separation device 32 is made to correspond, spray equipment 35 is arranged, and this spray equipment 35 and the pars basilaris ossis occipitalis of the dipping former membrane-separation tub 31 are connected by Rhine L5. A pump P2 is arranged in this Rhine L5, and with this pump P2, the processed water of a pars basilaris ossis occipitalis is circulated, and it is injected by the membrane module from spray equipment 35.

[0019] Next, actuation of the filtration film washing station of said configuration is explained. First, processed water is supplied to the dipping former membrane-separation tub 31 through Rhine L1, and filtration processing is started. In this filtration processing, only processed underwater treated water penetrates the film of a membrane module, and is sent to a treated water side, and impurity, sludge, etc. remain to a film surface. And if processed water is repeated and processed, impurity, sludge, etc. which remained will adhere to a film surface as solids gradually, and will form a cake layer.

[0020] Then, when the treated water obtained with the membrane module 32 turns around an initial complement the bottom, supply of processed water is stopped and filtration film washing processing is started. That is, said bulb is operated, the processed water in the dipping former membrane-separation tub 31 is discharged through the water extubation 33, and the film surface of a membrane separation device 32 is exposed to a gaseous phase. this time – a spray – as service water – the processed water in the dipping former membrane-separation tub 31 – constant-rate ***.

[0021] And a pump P2 is operated, the processed water of a pars basilaris ossis occipitalis is circulated through Rhine L5, and it injects from spray equipment 35 with high pressure to a membrane module. After carrying out fixed time amount injection of the processed water, processed water is again supplied to the dipping former membrane-separation tub 31, and filtration processing will be resumed if the water level to which this processed water was set is reached. In this case, since a film surface is exposed to a gaseous phase in case said processed water is injected to a membrane module, the momentum which processed water has can be made to act on a direct film surface. Therefore, the solid which was large as for impulse force when processed water hits a film surface, and adhered to the film surface can be made to fully exfoliate (** to vomit). Consequently, a solid is easily removable.

[0022] Moreover, since it is not necessary to process the wash water which it is not necessary not only to use another wash water, but contains the removed solid since processed water is used as an object for washing, cost can be made low. And since the film is not damaged since the compressed air is not used, and a sponge ball is not used, a membrane module can be washed uniformly, and further, since it is not necessary to take out this membrane module from a dipping former membrane-separation tub, an activity is simplified.

[0023] Next, a membrane separation device 32 and spray equipment 35 are explained to a detail. Drawing 1 is the detail drawing of the filtration film washing station in the example of this invention. In drawing, 31 is a dipping former membrane-separation tub, and it is immersed in this dipping former membrane-separation tub 31 in a membrane separation device 32. This membrane separation device 32 is formed by placing the membrane module 41 of a rectangle (******) configuration, and carrying out two or more sheet laminating of the predetermined spacing.

[0024] Moreover, each membrane module 41 of said membrane separation device 32 is made to correspond, and spray equipment 35 is arranged. This spray equipment 35 consists of two or more piping 43 with a water spray hole, and this piping 43 with a water spray hole is arranged in the location contiguous to the outermost membrane module 41 between each membrane module 41. The water spray hole which is not illustrated is formed in each piping 43 with a water spray hole, and processed water is injected from this water spray hole.

[0025] Said piping 43 with a water spray hole has the die length equivalent to the film width of said membrane module 41, and is arranged horizontally. And the interconnecting tube 45 prolonged at right angles to each piping 43 with a water spray hole is connected, and the common manifold 46 is connected to the upper limit of this interconnecting tube 45. On the other hand, this manifold 46 and the pars basilaris ossis occipitalis of the dipping former membrane-separation tub 31 are connected by Rhine L5. A pump P2 is arranged in this Rhine L5, the processed water of a pars basilaris ossis occipitalis is circulated, the piping 43 with a water spray hole is supplied through a manifold 46 and an interconnecting tube 45, and it is injected by the membrane module 41 from the water spray hole of this piping 43 with a water spray hole.

[0026] By the way, with the drive which is not illustrated, since you can make it go up and down in the direction of an arrow head now, said

manifold 46 can make it able to go up and down the piping 43 with a water spray hole along with a membrane module 41, and can apply processed water to the whole film surface. For example, if the piping 43 with a water spray hole is dropped and this piping 43 with a water spray hole arrives at the lower limit of a membrane module 41 while starting injection of processed water, the piping 43 with a water spray hole will be raised. And rise and fall of the piping 43 with a water spray hole are continued during multiple times or 1 scheduled time. After filtration film washing processing is completed, said piping 43 with a water spray hole is moved more nearly up than the upper limit of a membrane module 41 so that a flow of the processed water in filtration processing may not be barred.

[0027] Thus, since you can make it go up and down the piping 43 with a water spray hole, the film surface of a membrane module 41 can be washed uniformly. Next, the 2nd example of this invention is explained. Drawing 4 is the detail drawing of the filtration film washing station in the 2nd example of this invention. In drawing, 31 is a dipping former membrane-separation tub as a processing tub, and it is immersed in this dipping former membrane-separation tub 31 in a membrane separation device 52. This membrane separation device 52 keeps predetermined spacing for the membrane module 53 of a disk configuration, carries out two or more sheet laminating, and is formed by supporting free [rotation] with a shaft 54. [0028] Moreover, each membrane module 53 of said membrane separation device 52 is made to correspond, and spray equipment 55 is arranged. This spray equipment 55 consists of two or more piping 56 with a water spray hole, and this piping 56 with a water spray hole is arranged in the location contiguous to the outermost membrane module 53 between each membrane module 53. The water spray hole which is not illustrated is formed in each piping 56 with a water spray hole, and processed water is injected from this water spray hole. In this case, said water spray hole is formed covering the die length of a radius of the membrane module 53 of the lower part of the piping 56 with a water spray hole. And the common manifold 57 is connected to the upper limit of said piping 56 with a water spray hole. By the way, since said membrane module 53 can be rotated now with the drive which is not illustrated, processed water can be applied to the whole film surface.

[0029] On the other hand, said manifold 57 and the pars basilaris ossis occipitalis of the dipping former membrane-separation tub 31 are connected by Rhine L5. A pump P2 is arranged in this Rhine L5, the processed water of a pars basilaris ossis occipitalis is circulated, the piping 56 with a water spray hole is supplied through a manifold 57, and it is injected by the membrane module 53 from the water spray hole of this piping 56 with a water spray hole. In this case, although fixed, since a membrane module 53 is rotated, the piping 56 with a water spray hole can wash the film surface of this membrane module 53 uniformly.

[0030] Next, the 3rd example of this invention is explained. Drawing 5 is the conceptual diagram of the filtration film washing station in the 3rd example of this invention. In this case, a filtration film washing station is used in the process which performs biological treatment of a heavy load. Therefore, the biological treatment tank 61 and the dipping former membrane-separation tub 31 as a processing tub are connected by Rhine L1 and the water extubation 33, biological treatment is performed in the biological treatment tank 61, and filtration processing and filtration film washing processing are performed in the dipping former membrane-separation tub 31. In this filtration film washing processing, a pump P2 is operated, and the processed water of the pars basilaris ossis occipitalis of the dipping former membrane-separation tub 31 is supplied to spray equipment 35 through Rhine L5, and is injected by the membrane module 41 (drawing 1) of a membrane separation device 32 from this spray equipment 35. And in connection with treated water (biological treatment water) being made to dissociate from processed water in filtration processing, processed water is condensed and this processed water is returned to the biological treatment tank 61 through the water extubation 33. Therefore, high cell mass concentration is maintainable in this biological treatment tank 61. In addition, it is Rhine for setting L6 to the raw water supply line of processed water, setting L7 at the time of filtration, and drawing out some processed water.

[0031] By the way, in order to expose a film surface to a gaseous phase in injecting processed water to a membrane module 41 with said spray equipment 35, the processed water in the dipping former membrane-separation tub 31 is discharged through the water extubation 33. In this case, the water extubation 33 is connected with the biological treatment tank 61, and the discharged processed water is supplied to the biological treatment tank 61. So, it is necessary to secure the empty volume for ***** of the dipping former membrane-separation tank 31 to the biological treatment tank 61. Moreover, in order to supply the discharged processed water to the biological treatment tank 61, a pump P3 is arranged in the water extubation 33.

[0032] Next, actuation of the filtration film washing station of said configuration is explained. First, processed water is supplied to the dipping former membrane-separation tub 31 from the biological treatment tank 61 through Rhine L1, and filtration processing is started. In this filtration processing, only processed underwater treated water penetrates the film of a membrane module 41, and is sent to a treated water side, and impurity, sludge, etc. remain to a film surface. And if processed water is repeated and processed, impurity, sludge, etc. which remained will adhere to a film surface as solids gradually, and will form a cake layer.

[0033] Then, when the treated water obtained with the membrane module 41 turns around an initial complement the bottom, supply of processed water is stopped and filtration film washing processing is started. That is, said pump P3 is operated, the processed water in the dipping former membrane-separation tub 31 is discharged through the water extubation 33, and the biological treatment tank 61 is supplied. And the film surface of a membrane separation device 32 is exposed to a gaseous phase. this time -- a spray -- as service water -- the processed water in the dipping former membrane-separation tub 31 -- constant-rate ***.

[0034] And a pump P2 is operated, the processed water of the pars basilaris ossis occipitalis of the dipping former membrane-separation tub 31 is circulated through Rhine L5, and it injects from spray equipment 35 with high pressure to a membrane module 41. After carrying out fixed time amount injection of the processed water, a pump P2 is stopped, processed water is again supplied to the dipping former membrane-separation tub 31, and filtration processing will be resumed if the water level to which this processed water was set is reached.

[0035] Next, the 4th example of this invention is explained. Drawing 6 is the conceptual diagram of the filtration film washing station in the 4th example of this invention. In this case, a filtration film washing station is used in the condensation process which adds flocculants, such as a ferric chloride, in processed water, and removes a soluble COD component etc. Therefore, the condensation treated water tub 62 and the dipping former membrane-separation tub 31 as a processing tub are connected by Rhine L1 and the water extubation 33, a coagulation treatment is performed in said condensation treated water tub 62, and filtration processing and filtration film washing processing are performed in the dipping former membrane-separation tub 31. In addition, it is Rhine for setting L6 to the raw water supply line of processed water, setting L7 at the time of filtration, and drawing out some processed water.

[0036] Treated water is made to dissociate from processed water in said filtration processing. Moreover, a pump P2 is operated in filtration film washing processing, and the processed water of the pars basilaris ossis occipitalis of the dipping former membrane-separation tub 31 is supplied to spray equipment 35 through Rhine L5, and is injected by the membrane module 41 (drawing 1) of a membrane separation device 32 from this spray equipment 35. Consequently, the suspended solid which remained to the film surface in filtration processing is removable.

[0037] By the way, in order to expose a film surface to a gaseous phase in injecting processed water to a membrane module 41 with said spray equipment 35, the processed water in the dipping former membrane-separation tub 31 is discharged through the water extubation 33. In this case, the water extubation 33 is connected to the condensation treated water tub 62, and the discharged processed water is supplied to the condensation treated

water tub 62. So, it is necessary to secure the empty volume for ***** of the dipping former membrane-separation tank 31 to this condensation treated water tub 62. Moreover, in order to supply the discharged processed water to the condensation treated water tub 62, a pump P3 is arranged in the water extubation 33.

[0038] In addition, this invention is not limited to said example, and it is possible to make it deform variously based on the meaning of this invention, and it does not eliminate these from the range of this invention.

[0039]

[Effect of the Invention] According to this invention, a membrane separation device is immersed in a processing tub, and this membrane separation device is made to separate treated water from processed water in the filtration film washing approach, as explained to the detail above. And only the amount of setup is made to remain, the processed water in said processing tub is discharged, and the membrane module of said membrane separation device is exposed to a gaseous phase. Next, the processed water which remained is taken out from the pars basilaris ossis occipitalis of a processing tub, spray equipment is supplied, and it injects from this spray equipment to a membrane module.

[0040] In this case, since a film surface is exposed to a gaseous phase in case processed water is injected to a membrane module, the momentum which processed water has can be made to act on a direct film surface. Therefore, the solid which was large as for impulse force when processed water hits a film surface, and adhered to the film surface can be made to fully exfoliate. Consequently, a solid is easily removable.

[0041] Moreover, since it is not necessary to process the wash water which it is not necessary not only to use another wash water, but contains the removed solid since processed water is used as an object for washing, cost can be made low. And since the film is not damaged since the compressed air is not used, and a sponge ball is not used, a membrane module can be washed uniformly, and further, since it is not necessary to take out this membrane module from a processing tub, an activity is simplified.

[0042] In case processed water is injected to a membrane module, said spray equipment is made to go up and down along with a film surface in other filtration film washing approaches of this invention. In this case, the injected processed water is applied by the whole membrane module. Therefore, the film surface of this membrane module can be washed uniformly. In the filtration film washing approach of further others of this invention, in case processed water is injected to a membrane module, this membrane module is rotated. In this case, the injected processed water is applied by the whole membrane module. Therefore, the film surface of this membrane module can be washed uniformly.

[0043] In the filtration film washing approach of further others of this invention, while said processing tub and biological treatment tank are connected and processed water is supplied to said processing tub from this biological treatment tank, the processed water discharged from said processing tub is supplied to said biological treatment tank. In this case, treated water can be made to separate from the processed water which biological treatment ended. Therefore, since the condensed processed water can be returned to a biological treatment tank, high cell mass concentration is maintainable in a biological treatment tank.

[Translation done.]

*** NOTICES ***

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CLAIMS

[Claim(s)]

[Claim 1] In the filtration film washing approach of the waste water treatment equipment into which a membrane separation device is immersed in a processing tub, and treated water is made to separate from processed water with this membrane separation device (a) Make only the amount of setup remain, discharge the processed water in said processing tub, and the membrane module of said membrane separation device is exposed to a gaseous phase. (b) The filtration film washing approach characterized by taking out the processed water which remained from the pars basilaris ossis occipitalis of a processing tub, supplying spray equipment, and injecting from this spray equipment to a membrane module.

[Claim 2] The filtration film washing approach according to claim 1 which said spray equipment is made to go up and down along with a film surface in case processed water is injected to a membrane module.

[Claim 3] The filtration film washing approach according to claim 1 rotated by this membrane module in case processed water is injected to a membrane module.

[Claim 4] (a) The filtration film washing approach according to claim 1 that the processed water discharged from the (c) aforementioned processing tub is supplied to said biological treatment tank while said processing tub and biological treatment tank are connected and processed water is supplied to said processing tub from (b) this biological treatment tank.

[Claim 5] (a) The filtration film washing approach according to claim 1 that the processed water discharged from the (c) aforementioned processing tub is supplied to said condensation treated water tub while said processing tub and a condensation treated water tub are connected and processed water is supplied to said processing tub from (b) this condensation treated water tub.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the detail drawing of the filtration film washing station in the example of this invention.

[Drawing 2] It is drawing showing the conventional air back wash method.

[Drawing 3] It is the conceptual diagram of the filtration film washing station in the 1st example of this invention.

[Drawing 4] It is the detail drawing of the filtration film washing station in the 2nd example of this invention.

[Drawing 5] It is the conceptual diagram of the filtration film washing station in the 3rd example of this invention.

[Drawing 6] It is the conceptual diagram of the filtration film washing station in the 4th example of this invention.

[Description of Notations]

31 Dipping Former Membrane-Separation Tub

32 52 Membrane separation device

35 55 Spray equipment

41 53 Membrane module

61 Biological Treatment Tank

62 Condensation Treated Water Tub

[Translation done.]

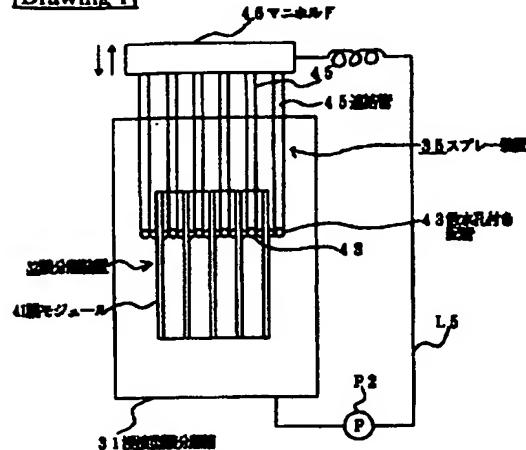
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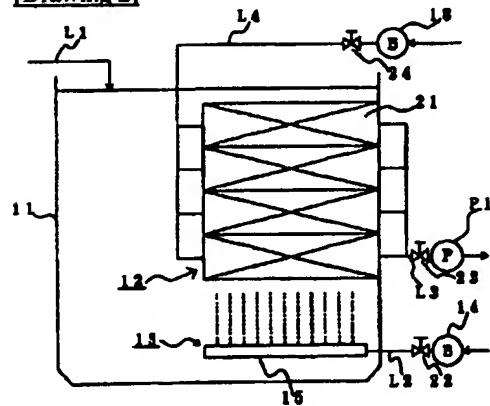
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DRAWINGS

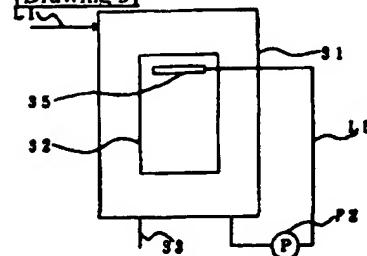
[Drawing 1]

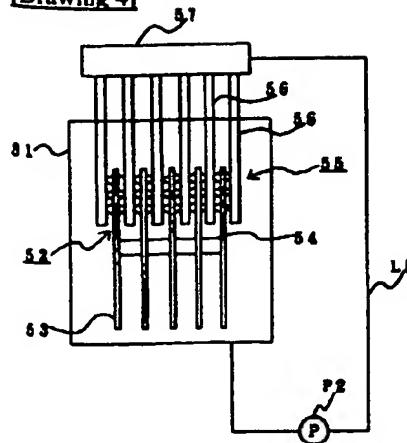
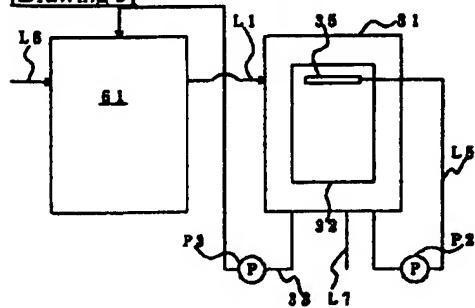
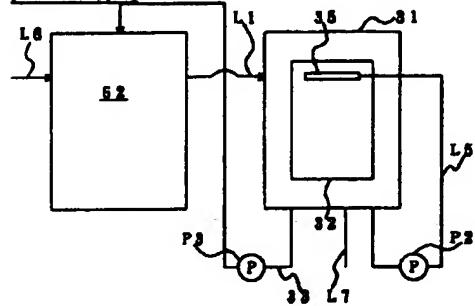


Drawing 21



[Drawing 3]



[Drawing 4]**[Drawing 5]****[Drawing 6]**

[Translation done.]

[0017]

[Examples] Hereinafter, an embodiment of the present invention is described in detail with reference to the drawings. FIG. 3 is a schematic view of a filter-membrane washing device in a first embodiment of the present invention. In the drawing, 31 is an immersion-type membrane separation tank, serving as a processing tank, to which water to be processed is supplied by way of a line L1. Furthermore, 32 is a membrane separation device, which is immersed in the immersion-type membrane separation tank 31, and which comprises a plurality of flat membrane modules, not shown in the drawing; from the water to be processed, only processed water is fed to the processed-water side by passing through the membrane of the membrane module.

[0018] Furthermore, 33 is a water removal pipe, formed at the bottom of the immersion-type membrane separation tank 31; by operating a valve disposed on this water removal pipe 33, which is not shown in the drawing, it is possible to evacuate the water to be processed from the emersion-type membrane separation tank 31. A spray device 35 is disposed corresponding to each of the membrane modules of the membrane separation device 32; and the bottom of the immersion-type membrane separation tank 31 is connected to this spray device 35 by a line L5. A pump P2 is disposed on this line L5 and the water to be processed at the bottom [of the tank] is circulated by this pump P2 and sprayed onto the membrane module from the spray device 35.

[0019] Next, the operation of a filter-membrane cleaning device having the constitution set forth above is described. First, water to be processed is supplied to the immersion-type membrane separation tank 31 by way of the line L1, and filtration processing begins. In this filtration processing, from the water to be processed, only processed water is fed to the processed-water side by passing through the membrane of the membrane module, and impurities, sludge and the like remain on the surface of the membrane. Then, with repeated processing of water to be processed, remaining impurities, sludge and the like progressively adhere as solids on the surface of the membrane, forming a cake layer.

[0020] Then, when the amount of processed water produced by the membrane module 32 falls below the required amount, supply of the water to be processed is stopped and filter-membrane cleaning operations begin. Specifically, the valve is operated so that the water to be processed is evacuated from the immersion-type membrane separation tank 31 by way of the water removal pipe 33, and the membrane

surface of the membrane separation device 32 is exposed to the gas phase. At this point, a certain amount of water to be processed is left in the immersion-type membrane separation tank 31 as spray water.

[0021] Then, the pump P2 is operated and the water to be processed at the bottom [of the tank] is circulated by way of the line L5 and sprayed against the membrane module at high pressure from the spray device 35. After spraying the water to be processed for a certain amount of time, water to be processed is once again supplied to the immersion-type membrane separation tank 31 and, when the water to be processed reaches the set water level, filtration operations are recommenced. In this case, when the water to be processed is sprayed against the membrane module, the membrane surface is exposed to the gas phase, and therefore the momentum of the water to be processed can act directly on the membrane surface. Accordingly, the impact force of the water to be processed that strikes the membrane surface is large, so that it is possible to fully detach the solids that have adhered to the membrane surface. Consequently, the solids can easily be removed.

[0022] Furthermore, since water to be processed is used for cleaning, not only is it unnecessary to use separate cleaning water, but there is no need to process cleaning water containing solids that have been removed, which allows for cost reductions. Furthermore, as compressed air is not used, the membrane is not damaged; as sponge balls are not used, the membrane module can be uniformly cleaned; and as it is not necessary to remove the membrane module from the immersion-type membrane separation tank, work is simplified.